

Level of Service For Pedestrian Towards The Performance of Passenger Information in Integrated Rail Transit Station: Sustainable Criteria For Station Design

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Abstract— Passenger information system (PIS) is very important to ease pedestrian while travelling in the integrated station which can encourage them to leave their private vehicle. It is part of sustainable element in station design. The main objective of this study is to determine the performance of passenger information in integrated rail transit station at Masjid Jamek based on pedestrian movement in station. Pedestrians' movement at several critical intersections in the station were recorded and observed through video observation. The video are then been analyzed based on the pedestrians movement delays in the station and level of service (LOS) will be given based on the delays. From the results, LOS for weekdays were slightly better than weekend may due to the passengers who commutes through the station are already familiar with the station layout since they are the frequent commuters for the related transit. PIS provided in the station can be improved more in future to encourage the private vehicle drivers to change their mode of transport to public transport especially light rail transit which currently cater most of urban commuters in Klang Valley. This can help to reduce the traffic congestions and carbon emissions on the road.

Index Terms— Level of service, passenger information system, pedestrian movement.

I. INTRODUCTION

In city centre, public transportation plays an important role in commuting urban people from one place to another place. Furthermore, the public transportation has a proven record of reducing congestion and carbon emissions [1]. The high number of public transportation ridership has encouraged the transit operator to deliver effective services. One of efficient criteria of an integrated station is based on the quality of the information provided to the passengers since integrated station is one of the critical stations in terms of passenger route choice which it combined two or more transportation subsystem or modes. A good service which delivered to the pedestrians will encourage more people to travel to places through public transportations. In other words, passenger information system is one of important element in delivering

the effective service to the public transport users and it is part of sustainable design criteria [2]. The main objective of this study is to determine the performance of passenger information in integrated rail transit station at Masjid Jamek based on pedestrian movement in the station which the delay results were compared with level of service (LOS) for pedestrian which stated in Highway Capacity Manual [3]. This study was focused in integrated station because integrated stations are more complex compared to the normal stations and it was also focused on several critical intersection in the station where the efficient and accurate passenger information are highly needed to ease the pedestrians to find the right way for them to go.

II. LITERATURE REVIEW

A. Station area and passenger flow identification

The structure of a station depends on the surrounding environment (e.g. terminal or transfer station, connecting to other underground interests), so it is important to understand the station structure and identify the station areas. Basically, the station areas include entrance/exit, concourse area, platform and connecting (path, tunnel, stair or elevator) between them. All the identified areas and their connections should be clear and definite to fully illustrate the station structure, and further can proceed to determine the passenger flows in the station [4]. There could be different information demands based on the traveling scopes and station areas. Therefore, it is very important and mandatory to provide complete information along the passenger flows on each traveling scope, respectively, ensuring a consistent and systematic design of the passenger information system [5].

B. Passenger Information System

Information system that should be provided to the passengers in a transit station are posted system information, real time schedule information, and way finding information, video security monitors, call box emergency, and elevator information availability. Signage is part of information system and it play an important roles to passenger movement in a transit station. Signage types could be defined and classified in many ways according to different principles and standards. In this study, for a purpose of generating an information system in one station, signs are classified into three categories which are guidance signs, normative signs,

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and indication signs [5].

C. Pedestrian flow and behaviour in transit station

There are several studies describing and analyzing passenger information system for public transport but fewer studies evaluate the passenger information system based on pedestrian movement or behavior inside stations.

The first found study was done by [6] to identify the practical passenger passing flow capacity of metro station facilities. The article concludes that there are many facilities that did not meet the demanded flows during peak hours or the demanded design values. This sometimes leads to very severe queuing development in some parts of the station such as at the automatic escalators or at the security check.

A research was done by [7] to investigate the behavior of passengers on railway platforms and the effect of information, seats and entrances along the platform has on their behavior. Most of the passengers did not know that information exists and on average, stands much further away from their closest door when the train arrives compared to passengers that believe themselves to know where their car will stop along the platform.

D. Level of Service (LOS)

Level of service (LOS) is defined as a method by which a transportation facility's performance is evaluated. In mutual word, it is a measurement to describe the operational situations of the facility's traffic stream and the user's opinion of those conditions within the area of evaluation [3]. In Highway Capacity Manual which was developed by [3] stated that, LOS are generally consists of A to F rating level which A is perfect or very good while F is for worst condition.

III. METHODOLOGY

Pedestrians' movement in the station are recorded and observed through video observation. Video recording is one of the effective ways to record and analyzed pedestrian movement and behavior on any desired period. The video camera are set at several strategic area and focused on critical reference points which the selected reference points must be intersection type in the station. Relatively, the strategic areas are identified during the site visit before the camera are set on the points. The data was collected on weekdays and weekends to get the clear movement pattern on those different days.

The analysis are focused on the calculation that explains the relationship between the efficiency of provided informations mainly signage in the station with the delay time of pedestrians movement. Basically, the delay which in time unit for each pedestrian to cross an intersection in the station are determined and the delay will be compared with the LOS table as shown in table 1 which provided in Highway Capacity Manual to get which LOS as the final result for this study.

Table I. LOS Criteria for pedestrians [3]

LOS	Pedestrian Delay	Descriptions
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	(seconds)	
A	< 5	Good
B	≥ 5 – 10	
C	> 10 – 20	Moderate
D	> 20 – 30	
E	> 30 – 45	Bad
F	> 45	Very Bad

IV. FINDINGS AND DISCUSSION

Overall results shows that, for weekdays the worst LOS is C (17.92 seconds) while for worst LOS in weekend is D (21.30 seconds) as per shown in table 2 and table 3 below.

Table II. Pedestrians delays on weekdays and weekend

Hour (Time)	Delay Time (seconds)	
	Weekdays	Weekend
7 am – 9 am	16.78	19.73
12 pm – 2 pm	19.86	24.02
4 pm – 6 pm	17.12	20.15

Table III. LOS of pedestrians on weekdays and weekend

Hour (Time)	Level Of Service (LOS)	
	Weekdays	Weekend
7 am – 9 am	B	A
12 pm – 2 pm	C	D
4 pm – 6 pm	B	C

There are several behaviors of pedestrian were found during the CCTV video analysis. The behaviors has been categorized according to the situation in the station which has been listed as follows:

- i. Pedestrians totally confused with the existing information in the station and directly asked the Customer Service Personnel.
- ii. Pedestrians confused in selecting the right way in front of the intersection inside the paid area.
- iii. Pedestrians hesitated in choosing the right way at intersection which some of them chosen the right one while some of them have to return to the starting point at the intersection.
- iv. Pedestrians that confidently chosen the wrong path without making stops or try to look at the information given on the signage but returned back to choose the right path.
- v. Passenger that frequently travel using the station will confidently walk through the intersections without hesitating or make any stop or looked at the information given on the signage. Normally, this type of passenger travelled through the station are suited with their working suit.

LOS for stations are based on the delay time of pedestrian movement which related to their confusing on the information

system provided in the building. As we can see the result above, the pedestrians on weekend are more confused with the information system provided in the stations. Pedestrians, during that period are maybe not familiar with the layout of the building. From the observation, most tourists takes more time to complete their journey in the station. It can be said that maybe for the tourist, they are not much understand with the PIS which some of it were provided in Malay language. LOS for weekdays were slightly better than weekend may due to the passengers who commutes through the station are already familiar with the station layout since they are the frequent commuters for the related transit.

- [4] Metropolitan Council 2012 Station and Support Facility Design Guidelines User Guide; A Supplement To The Regional Transitway Guidelines (Minnesota: Metropolitan Council)
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V. CONCLUSION

From this study, it was found that the highest number of confused passengers were during over weekend. This scenario happened because most of the pedestrians are the frequent user of the LRT station to go to their workplaces and not much of the non-familiar user commutes during over weekdays. Furthermore, LOS for weekdays were slightly better than weekend may due to the passengers who commutes through the station are already familiar with the station layout since they are the frequent commuters for the related transit.

These conclude the performance of PIS based on pedestrian movement and behavior which the results shows that it achieved LOS D for worst on weekend and this means that the PIS provided in the integrated rail transit station in Masjid Jamek can be improved more in future to ensure smooth riding and travelling for the rail transit commuters to encourage them and the private vehicle drivers to change their mode of transport to public transport especially light rail transit which currently cater most of urban commuters in Klang Valley.

The passenger informations are very important to attract more users to use public transportation especially light railway transit if it were provided in a most efficient manner. This can be a part of sustainable criteria in station design which helps to reduce the travel delay time by the commuters and reduce the carbon emissions created by the private vehicles on road.

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